

**TITLE**

**ALARM MANAGEMENT SYSTEM AND METHOD THEREOF FOR  
NETWORK MANAGEMENT SYSTEM**

**CLAIM OF PRIORITY**

This application claims priority to an application entitled "*SYSTEM AND METHOD FOR MANAGING ALARM IN NETWORK MANAGEMENT SYSTEM*" filed in the Korean Industrial Property Office on December 1, 2000 and assigned Serial No. 2000-72604, the contents of which are hereby incorporated by reference.

**BACKGROUND OF THE INVENTION**

**Technical Field**

The present invention relates generally to a network management system (NMS), and in particular, to a system and method for storing alarm information generated from a network and transferring the alarm information to a plurality of alarm managers.

**Related Art**

A network management system can monitor the state of a communication network all the time to maintain the network in an optimal state and can collect network state information, alarm information, and traffic data. When network alarm information is not handled efficiently, there can be inconvenience and difficulty.

1           There is a need to efficiently handle network alarm information. Exemplars of recent  
2 efforts include U.S. Patent No. 6,040,770 to Britton, entitled *COMMUNICATION PATH*  
3 *INTEGRITY SUPERVISION IN A NETWORK SYSTEM FOR AUTOMATIC ALARM DATA*  
4 *COMMUNICATION*, issued on March 21, 2000, U.S. Patent No.5,621,383 to Yoshiyama,  
5 entitled *RING NETWORK SYSTEM CAPABLE OF DETECTING AN ALARM IN EACH NODE*,  
6 issued on April 15, 1997, U.S. Patent No.6,064,304 to Arrowsmith *et al.*, entitled *METHOD*  
7 *AND APPARATUS FOR POLICY-BASED ALARM NOTIFICATION IN A DISTRIBUTED*  
8 *NETWORK MANAGEMENT ENVIRONMENT*, issued on May 16, 2000, U.S. Patent  
9 No.6,057,757 to Arrowsmith *et al.*, entitled *METHOD AND APPARATUS FOR POLICY-BASED*  
10 *ALARM NOTIFICATION IN A DISTRIBUTED NETWORK MANAGEMENT ENVIRONMENT*,  
11 issued on May 2, 2000, U.S. Patent No. 5,777,549 to Arrowsmith *et al.*, entitled *METHOD AND*  
12 *APPARATUS FOR POLICY-BASED ALARM NOTIFICATION IN A DISTRIBUTED NETWORK*  
13 *MANAGEMENT ENVIRONMENT*, issued on July 7, 1998, U.S. Patent No. 5,696,486 to Poliquin  
14 *et al.*, entitled *METHOD AND APPARATUS FOR POLICY-BASED ALARM NOTIFICATION IN*  
15 *A DISTRIBUTED NETWORK MANAGEMENT ENVIRONMENT*, issued on December 9, 1997,  
16 U.S. Patent No.5,768,501 to Lewis, entitled *METHOD AND APPARATUS FOR INTER-*  
17 *DOMAIN ALARM CORRELATION*, issued on June 16, 1998, and U.S. Patent No. 6,138,249 to  
18 Nolet, entitled *METHOD AND APPARATUS FOR MONITORING COMPUTER SYSTEMS*  
19 *DURING MANUFACTURING, TESTING AND IN THE FIELD*, issued on October 24, 2000.

20           While these recent efforts provide advantages, I note that they fail to adequately provide a

1 method for efficiently and conveniently handling network alarm information.

## 2 SUMMARY OF THE INVENTION

3 It is, therefore, an object of the present invention to provide an alarm management system  
4 and a method thereof for a network management system, wherein alarm information generated  
5 from a network is managed in multiple distributed tables.

6 It is another object of the present invention to provide a system and method for  
7 transferring alarm information stored in multiple distributed tables among alarm managers by  
8 broadcasting and polling.

9 To achieve the above objects and others, there is provided an alarm management system  
10 and a method thereof in a network management system. According to one aspect of the present  
11 invention, a management information system (MIS) notifies an alarm management host computer  
12 that an alarm is generated from a network in the alarm management system. The alarm  
13 management host computer manages the alarm information received from the management  
14 information system. A plurality of alarm managers are connected to the alarm management host  
15 computer. The alarm management host computer has an uncleared alarm table storage for  
16 storing uncleared alarm information, a cleared alarm table storage for storing cleared alarm  
17 information, and an alarm management processor for controlling the generated alarm information  
18 to be stored in the uncleared alarm table storage, to be cleared from the uncleared alarm table

1 storage when the alarm is released, and then to be stored in the cleared alarm table storage.

2 According to another aspect of the present invention, an alarm management processor  
3 makes an uncleared alarm table for storing alarm information that was generated from a network  
4 and is not cleared yet and a cleared alarm table for storing cleared alarm information in the alarm  
5 management method. Then, the alarm management processor makes a plurality of listener tables  
6 corresponding to alarm managers connected to the alarm management processor and registers the  
7 listener tables in a broadcasting list table. Upon generation of alarm information from a network,  
8 the alarm management processor stores alarm information in the uncleared alarm table and the  
9 listener tables registered in the broadcasting list table. The alarm managers read the alarm  
10 information from the listener tables. When the alarm is released, the alarm management  
11 processor clears the alarm information from the uncleared alarm table and stores the alarm  
12 information in the cleared alarm table.

13 To achieve these and other objects in accordance with the principles of the present  
14 invention, as embodied and broadly described, the present invention provides an apparatus,  
15 comprising: a management information system outputting alarm information corresponding to an  
16 alarm event and outputting an alarm clear signal corresponding to an end of said alarm event; an  
17 alarm management host receiving said alarm information, said host having a broadcasting list  
18 data table, said host having an alarm database including a first data table and a second data table,  
19 said host having a plurality of memory spaces and a plurality of listener tables; a processor being

1 coupled to said host, said processor storing said alarm information in said first data table when  
2 said alarm information is received by said host, said processor removing said alarm information  
3 from said first data table and storing said alarm information in said second data table when said  
4 alarm event is cleared, said alarm event being cleared when said alarm clear signal is output; and  
5 a plurality of alarm managers being connected to said host, said plurality of alarm managers  
6 including a first alarm manager, said listener tables including a first listener table corresponding  
7 to said first alarm manager, each of said listener tables having a unique name listed in said  
8 broadcasting list data table, said first listener table having a first unique name; said processor  
9 storing said alarm information in each of said listener tables listed in said broadcasting list data  
10 table; after said storing of said alarm information in said listener tables is completed, said alarm  
11 managers reading said alarm information stored in said respective listener tables; when said  
12 reading of said alarm information is performed, said alarm managers performing at least one  
13 selected from among displaying said alarm information, printing said alarm information,  
14 transmitting an e-mail message including said alarm information, transmitting a pager message  
15 including said alarm information, and transmitting a facsimile message including said alarm  
16 information; when said reading of said alarm information is performed, said alarm managers  
17 removing said alarm information from said listener tables to prevent re-reading of said alarm  
18 information; when said management information system performs said outputting of said alarm  
19 clear signal, said processor performing said removing of said alarm information from said first  
20 data table and performing said storing of said alarm information in said second data table.

To achieve these and other objects in accordance with the principles of the present invention, as embodied and broadly described, the present invention provides a method, comprising: outputting alarm information corresponding to an alarm event and outputting an alarm clear signal corresponding to an end of said alarm event, said outputting being performed by a network; receiving said alarm information, said receiving being performed by a host, said host having a broadcasting list data table, a plurality of memory spaces, a plurality of listener tables, and an alarm database including a first data table and a second data table; when said alarm information is received by said host, storing said alarm information in said first data table; when said alarm event is cleared, removing said alarm information from said first data table and storing said alarm information in said second data table, said alarm event being cleared in response to said outputting of said alarm clear signal; connecting a plurality of alarm managers to said host, said plurality of alarm managers including a first alarm manager, said listener tables including a first listener table corresponding to said first alarm manager, each of said listener tables having a unique name listed in said broadcasting list data table, said first listener table having a first unique name; storing said alarm information in each of said listener tables listed in said broadcasting list data table; after said storing of said alarm information in said listener tables is completed, reading said alarm information stored in said listener tables, said reading of said alarm information stored in said listener tables corresponding to each one of said respective alarm managers reading said alarm information stored in each one of said respective listener tables; when said reading of said alarm information is performed by said alarm managers, performing at least one selected from among displaying said alarm information, printing said

1 alarm information, transmitting an e-mail message including said alarm information, transmitting  
2 a pager message including said alarm information, and transmitting a facsimile message  
3 including said alarm information; when said reading of said alarm information is performed,  
4 removing said alarm information from said listener tables to prevent re-reading of said alarm  
5 information; and when said management information system performs said outputting of said  
6 alarm clear signal, performing said removing of said alarm information from said first data table  
7 and performing said storing of said alarm information in said second data table.

8 To achieve these and other objects in accordance with the principles of the present  
9 invention, as embodied and broadly described, the present invention provides an alarm  
10 management method for a network management system, comprising the steps of: making an  
11 uncleared alarm table for storing alarm information that is generated from a network and that is  
12 not cleared, and making a cleared alarm table for storing alarm information that is cleared;  
13 storing first alarm information in the uncleared alarm table when the first alarm information is  
14 generated from the network, said first alarm information corresponding to an alarm event; and  
15 when the alarm event ends, removing said first alarm information from the uncleared alarm table  
16 and storing the first alarm information in the cleared alarm table.

17 To achieve these and other objects in accordance with the principles of the present  
18 invention, as embodied and broadly described, the present invention provides an alarm  
19 management method for managing an alarm in a network, said method comprising: creating a

1 plurality of listener data tables for storing information, each one of said listener data tables  
2 corresponding to one respective alarm manager selected from among a plurality of alarm  
3 managers, each one of said listener data tables having a unique name; detecting whether said  
4 alarm managers are operating normally; registering in a broadcasting list data table said unique  
5 names identifying said listener data tables corresponding to said alarm managers that are detected  
6 to be operating normally; when an alarm event is generated in said network, storing first alarm  
7 information in said listener data tables corresponding to said names registered in said  
8 broadcasting list data table; and reading said first alarm information from said listener data tables  
9 by said corresponding alarm managers.

10 To achieve these and other objects in accordance with the principles of the present  
11 invention, as embodied and broadly described, the present invention provides an alarm  
12 management method for an alarm management processor connected to a plurality of alarm  
13 managers, comprising the steps of: making an uncleared alarm table for storing alarm  
14 information corresponding to an alarm event that is generated from a network and that is not  
15 cleared, and making a cleared alarm table for storing alarm information corresponding to an  
16 alarm event that is cleared; making a plurality of listener tables corresponding to the alarm  
17 managers; registering the listener tables in a broadcasting list table; storing alarm information in  
18 the uncleared alarm table when the alarm event is generated from the network; storing the alarm  
19 information in the listener tables registered in the broadcasting list table; reading the alarm  
20 information from the listener tables, said reading being performed by the alarm managers; and



1 when the alarm event is released, clearing the alarm information from the uncleared alarm table  
2 and storing the alarm information in the cleared alarm table.

3 To achieve these and other objects in accordance with the principles of the present  
4 invention, as embodied and broadly described, the present invention provides an apparatus for  
5 managing an alarm event occurring in a network, said system comprising: a management  
6 information system outputting alarm information corresponding to an alarm event; an alarm  
7 management host computer managing said alarm information received from said management  
8 information system; and a plurality of alarm managers being connected to said alarm  
9 management host computer, said plurality of alarm managers reading said alarm information  
10 when said alarm information is not cleared, said plurality of alarm managers including a first  
11 alarm manager; said alarm management host computer having a first data table for storing said  
12 alarm information when said alarm information is not cleared, a second data table for storing said  
13 alarm information when said alarm information is cleared, said alarm management host computer  
14 storing said alarm information in said first data table when said alarm information is not cleared,  
15 said alarm management host computer removing said alarm information from said first data table  
16 and storing said alarm information in said second data table when said alarm information is  
17 cleared, said alarm information being cleared when said alarm event ends.

18 The present invention is more specifically described in the following paragraphs by  
19 reference to the drawings attached only by way of example. Other advantages and features will

become apparent from the following description and from the claims.

## BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, which are incorporated in and constitute a part of this specification, embodiments of the invention are illustrated, which, together with a general description of the invention given above, and the detailed description given below, serve to exemplify the principles of this invention.

FIG. 1 is a block diagram of an alarm management system;

FIG. 2 is a block diagram of an alarm management system, in accordance with the principles of the present invention;

FIG. 3 is a flowchart illustrating an alarm management operation, in accordance with the principles of the present invention;

FIG. 4 is a detailed flowchart illustrating a recording and reading operation in tables, in accordance with the principles of the present invention; and

FIG. 5 is a flowchart illustrating a recording and reading operation in listener tables, in accordance with the principles of the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

While the present invention will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the present invention are shown, it is to be understood at the outset of the description which follows that persons of skill in the

1 appropriate arts may modify the invention here described while still achieving the favorable  
2 results of this invention. Accordingly, the description which follows is to be understood as being  
3 a broad, teaching disclosure directed to persons of skill in the appropriate arts, and not as limiting  
4 upon the present invention.

5 In the interest of clarity, not all features of an actual implementation are described. In the  
6 following description, well-known functions or constructions are not described in detail since  
7 they would obscure the invention in unnecessary detail. It will be appreciated that in the  
8 development of any actual embodiment numerous implementation-specific decisions must be  
9 made to achieve the developers' specific goals, such as compliance with system-related and  
10 business-related constraints, which will vary from one implementation to another. Moreover, it  
11 will be appreciated that such a development effort might be complex and time-consuming, but  
12 would nevertheless be a routine undertaking for those of ordinary skill having the benefit of this  
13 disclosure.

14 A network alarm management system stores plural pieces of alarm information generated  
15 from the network and transfers the alarm information to a plurality of alarm management  
16 computers connected to the network alarm management system.

17 FIG. 1 is a block diagram of a network alarm management system. Referring to FIG. 1, a  
18 computer-based management information system (MIS) 110 collects state information generated

1 from a network. The management information system 110 is a system that includes computer  
2 hardware, software, data, procedures, and people as its components, for processing data  
3 generated from the network and produces diverse pieces of information. Especially, upon  
4 notification of generation of an alarm event from the management information system 110, an  
5 alarm management processor 120 of an alarm management host computer 100 stores information  
6 about the alarm event in a predetermined form in an alarm database 130 formatted in a single  
7 structural table. A plurality of alarm managers 140 to 144 displays uncleared alarm information  
8 in real time, referring to the alarm database 130. An alarm event can be an error that occurs  
9 during a data transmission, a quantity of errors exceeding a predetermined amount, a network  
10 component failing to respond to polling, or any other type of fault condition.

11 In the above alarm management method, cleared alarm information and uncleared alarm  
12 information are stored without discrimination in a single alarm table. Therefore, when an alarm  
13 is cleared, an operator must clear corresponding alarm information referring to the entire alarm  
14 table, expending much effort and time.

15 The operation of many alarm managers causes heavy load on the single alarm table when  
16 they refer to the table. Consequently, the performance of the alarm managers is remarkably  
17 decreased and an alarm history is reviewed at a lower speed. In addition, since all the alarm  
18 managers share the single alarm table, an alarm management application program should be  
19 developed to search the alarm table every time a new NMS is implemented.

FIG. 2 is a block diagram of an alarm management system according to the present invention. Referring to FIG. 2, an alarm management host computer 200 is a workstation for managing a network, including an alarm management processor 220, a broadcasting list table 230, an alarm database 240, and a plurality of listener tables 250 to 253.

The alarm management processor 220 operates according to an alarm management application program being a daemon application program. As known, a daemon is a resident program that executes computer system-associated operations in the background. That is, when a task to be processed occurs, the alarm management daemon is automatically invoked from the background and implements the task. A daemon is a program that is not invoked explicitly, but lies dormant waiting for some condition to occur.

The alarm database 240 of a multiple distributed table structure includes an alarm identifier (ID) table 241, an uncleared alarm table 243, and a cleared alarm table 245. The alarm management processor 220 of the host computer 200 stores alarm information that was generated from the network and is not cleared yet in the uncleared alarm table 243, and if the alarm information is cleared, it clears the alarm information from the uncleared alarm table 243 and stores the alarm information in the cleared alarm table 245.

The alarm management processor 220 is connected to workstations, personal computers (PCs), or a plurality of alarm managers 260 to 263 that run in an application program of the

1 alarm management processor 220 in order to support distributed alarm management of plural  
2 operators. Unless the alarm managers 260 to 263 read alarm information from the uncleared  
3 alarm table 243 at a synchronous time, some alarm managers may read cleared alarm information  
4 earlier and other alarm managers may read only uncleared alarm information later. In this case,  
5 the alarm managers may have different alarm information.

6 To prevent this problem, the alarm managers 260 to 263 each secure unique alarm  
7 information sensing areas, listener tables 250 to 253. The names of the listener tables 250 to 253  
8 are registered in the broadcasting list table 230. Alarm information generated from the network  
9 is stored both the uncleared alarm table 243 and the listener tables 250 to 253 at the same time.  
10 The alarm managers 260 to 263 each read alarm information from their respective listener tables  
11 250 to 253.

12 The alarm managers 260 to 263 can be configured to perform different tasks. The alarm  
13 managers 260 to 263 can display the alarm information that was read from the listener tables 250  
14 to 253, can create e-mail messages containing the alarm information and transmit those e-mail  
15 messages over the Internet (not shown) or over other networks (not shown) or to a personal  
16 digital assistant (PDA) (not shown) or to other electronic devices (not shown), can transmit the  
17 alarm information in a fax message to a fax machine 510, and can transmit the alarm information  
18 in a pager message to a pager 500. For example, an operator at alarm manager 260 can press a  
19 key (not shown) to manually request that alarm manager 260 send a fax message to fax machine

1 510, using a modem (not shown) in alarm manager 260. Also, for example, the alarm manager  
2 261 can be pre-programmed to send the alarm information to pager 500.

3 FIG. 3 is a flowchart illustrating an alarm management operation according to the present  
4 invention. Referring to FIG. 3, the alarm management processor 220 makes the uncleared alarm  
5 table 243 and the cleared alarm table 245 within the alarm database 240 in step S110. Since the  
6 number of uncleared alarms is normally smaller than that of cleared alarms, the uncleared alarm  
7 table 243 should be smaller than the cleared alarm table 245.

8 In S120, the alarm managers 260 to 263 connected to the alarm management host  
9 computer 200 secure memory space for use as listener tables in the host computer 200 using their  
10 process identifiers (IDs) and generate the listener tables 250 to 253. In S130, the alarm managers  
11 260 to 263 store the names of their listener tables 250 to 253 in the broadcasting list table 230.  
12 For example, the names of the listener tables 250 to 253 can be the process identifiers of the  
13 alarm managers 260 to 263. If one of the alarm managers 260 to 263 is inoperative, the name of  
14 its listener table is cleared from the broadcasting list table 230.

15 If an alarm is generated from the network, the alarm management processor 220 stores  
16 information about the alarm in the uncleared alarm table 243 in S140. The step of S140 will be  
17 described in detail hereinbelow.

Upon generation of an alarm from the network, the management information system (MIS) 110 transmits an alarm generation event message representing generation of the alarm to the host computer 200. An alarm event message generated from the management information system (MIS) 210 typically includes the following fields, as shown in Table 1 below.

**<Table 1>**

Information fields of the alarm event message

dn	alarm position
event type	alarm type
severity	alarm level
probable cause	alarm cause
additional text	alarm additional information
event time	alarm generation time

The alarm management processor 220 parses the alarm generation event message received from the management information system (MIS) 210 and generates alarm information in a predetermined form. Here, the alarm management processor 220 checks unused alarm identifiers (IDs) referring to the alarm identifier (ID) table 241 having a plurality of alarm identifiers stored therein to discriminate alarms generated from the network, assigns an unused alarm identifier to the alarm information, and stores the alarm information in the uncleared alarm table 243.

In step S150, the alarm management processor 220 stores the alarm information in the



1 listener tables 250 to 253. The step of S150 will be described in detail hereinbelow.

2 After generating the alarm information, the alarm management processor 220 checks  
3 whether the alarm managers 260 to 263 with the listener tables 250 to 253 registered in the  
4 broadcasting list table 230 each operate normally. If processor 220 sense that an abnormal alarm  
5 manager exists, the name of its listener table is cleared from the broadcasting list table 230 in  
6 order to prevent unnecessary storage of the alarm information in the listener table of the  
7 abnormal alarm manager.

8 Then, the alarm management processor 220 simultaneously transmits all alarm  
9 information to the registered listener tables 250 to 253 referring to the broadcasting list table 230.  
10 Before the alarm information is stored in the listener tables 250 to 253, the alarm management  
11 processor 220 sets the listener tables 250 to 253 to a lock mode so that the alarm managers 260 to  
12 263 cannot access the listener tables 250 to 253 during recording the alarm information. If the  
13 recording operation is completed, the alarm management processor 220 releases the listener  
14 tables 250 to 253 from the lock mode to allow the alarm managers 260 to 263 to access the  
15 listener tables 250 to 253.

16 In step S160, the alarm managers 260 to 263 check whether alarm information is stored in  
17 their respective listener tables 250 to 253 periodically or when an operator requests. If the stored  
18 alarm information exists, the alarm managers 260 to 263 read the alarm information, display or

1 print the alarm information, and clear or remove the alarm information from the listener tables  
2 250 to 253 to prevent re-reading of the alarm information. Also, the alarm managers can  
3 transmit an e-mail message including the alarm information, transmit a pager message including  
4 the alarm information to a pager 500, and transmit a fax message including the alarm information  
5 to a remote fax machine 510.

6 If the alarm is released, the alarm management processor 220 clears the alarm information  
7 from the uncleared alarm table 243 and stores the alarm information in the cleared alarm table  
8 245 in step S170, which is described in detail below.

9 If the alarm is released in the network, the management information system (MIS) 210  
10 transmits an alarm release event message representing release of the alarm to the alarm  
11 management host computer 200. The alarm release event message has the field "severity" set to  
12 "clear". The alarm management processor 220 parses the alarm release event message received  
13 from the management information system 210, looks up alarm information with a corresponding  
14 alarm identifier (ID) in the uncleared alarm table 243, automatically clears the alarm information  
15 from the uncleared alarm table 243, and inserts the alarm information in the cleared alarm table  
16 245.

17 Unless information about a cleared alarm is automatically cleared due to problems  
18 including a line abnormality between the management information system (MIS) 210 and the

1 host computer 200, an operator can request the alarm management processor 220 to manually  
2 clear the alarm information using the alarm managers 260 to 263. Upon the request of manual  
3 clear, the alarm management processor 220 clears the alarm information from the uncleared  
4 alarm table 243 and stores the alarm information in the cleared alarm table 245.

5 FIG. 4 is a flowchart illustrating a recording and reading operation in the tables according  
6 to the present invention. Referring to FIG. 4, in step S01, upon receipt of an alarm generation  
7 event message from the management information system, the alarm management processor stores  
8 corresponding alarm information in a listener table 0001 (250) registered in the broadcasting list  
9 table 230. A corresponding alarm manager reads the alarm information from the listener table by  
10 polling periodically or every time an alarm is generated.

11 In step S02, upon receipt of an alarm clear event message from the management  
12 information system, the alarm management processor 220 looks up corresponding alarm  
13 information in the uncleared alarm table 243, clears the alarm information, and automatically  
14 inserts the alarm information in the cleared alarm table 245. The alarm manager, especially  
15 when it wants to review an alarm history, may monitor changes of alarm information in the  
16 uncleared alarm table 243 and the cleared alarm table 245 and display them on a display.

17 In step S03, if the operation requests the alarm management processor 220 to manually  
18 clear alarm information using the alarm manager, the alarm management processor 220 looks up

the alarm information in the uncleared alarm table 243, clears it from the uncleared alarm table 243, and stores it in the cleared alarm table 245.

In step S04, when the alarm management procedure ends due to power-off of the computer of the alarm manager or termination of its application program, the alarm manager requests the alarm management processor 220 to clear its listener table before the procedure ends. In response to the request, the alarm management processor 220 deletes the listener table.

FIG. 5 is a detailed flowchart illustrating a recording and reading operation in listener tables according to the present invention. It is assumed here that the names of listener tables registered in the broadcasting list table 230 are listener\_0001, listener\_0002, and listener\_0003.

Referring to FIG. 5, the alarm management processor 220 sets listener table #0001 named listener\_0001 to a lock mode, records generated alarm information in listener table #0001, and then releases it from the lock mode in step S11. The reason for the alarm management processor to set listener table #0001 to the lock mode is to prevent alarm manager #0001 corresponding to listener table #0001 from accessing listener table #0001 during recording of the alarm information. In step S12, alarm manager #0001 sets listener table #0001 to the lock mode, reads the alarm information from listener table #0001, and then releases it from the lock mode. The reason for alarm manager #0001 to set listener table #0001 to the lock mode is to prevent the alarm management processor 220 from accessing listener table #0001 during reading the alarm

1 information.

2 Similarly, the alarm management processor 220 sets listener tables #0002 and #0003 to  
3 the lock mode, records the same alarm information in listener tables #0002 and #0003, and then  
4 releases them from the lock mode in steps S13 and S15. In steps S14 and S16, alarm managers  
5 #0002 and #0003 set listener tables #0002 and #0003 to the lock mode, read the alarm  
6 information from listener tables #0002 and #0003, and then release them from the lock mode.

7 In accordance with the present invention as described above, alarm information is readily  
8 looked up using distributed multiple tables for alarm management in a network management  
9 system, thereby saving time and efforts of an operator. Since a plurality of alarm managers have  
10 their respective listener tables, asynchronous access to alarm information is solved and load  
11 during the access is decreased.

12 That is, the present invention is advantageous in that load is distributed due to distributed  
13 management of alarm data, a decrease in an alarm information search speed caused when  
14 accumulated alarm information reaches a certain level is prevented, heavy load during polling of  
15 alarm data is overcome, the efficiency and speed of alarm history reviewing are increased, and  
16 alarm managers can be managed by use of listener tables.

17 While the present invention has been illustrated by the description of embodiments

1     thereof, and while the embodiments have been described in considerable detail, it is not the  
2     intention of the applicant to restrict or in any way limit the scope of the appended claims to such  
3     detail. Additional advantages and modifications will readily appear to those skilled in the art.  
4     Therefore, the invention in its broader aspects is not limited to the specific details, representative  
5     apparatus and method, and illustrative examples shown and described. Accordingly, departures  
6     may be made from such details without departing from the spirit or scope of the applicant's  
7     general inventive concept.